

LA-UR- 03 - 7795

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Title: DESIGN AND PERFORMAMCE OF THE PHENIX MUON
TRACKING SYSTEMS

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Submitted to: 2003 IEEE NUCLEAR SCIENCE SYMPOSIUM AND
MEDICAL IMAGING CONFERENCE
PORTLAND, OREGON, USA
OCTOBER 19-25, 2003



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Form 836 (8/00)



Design and Performance of the PHENIX Muon Tracking Systems
David M. Lee for the PHENIX Collaboration

Abstract

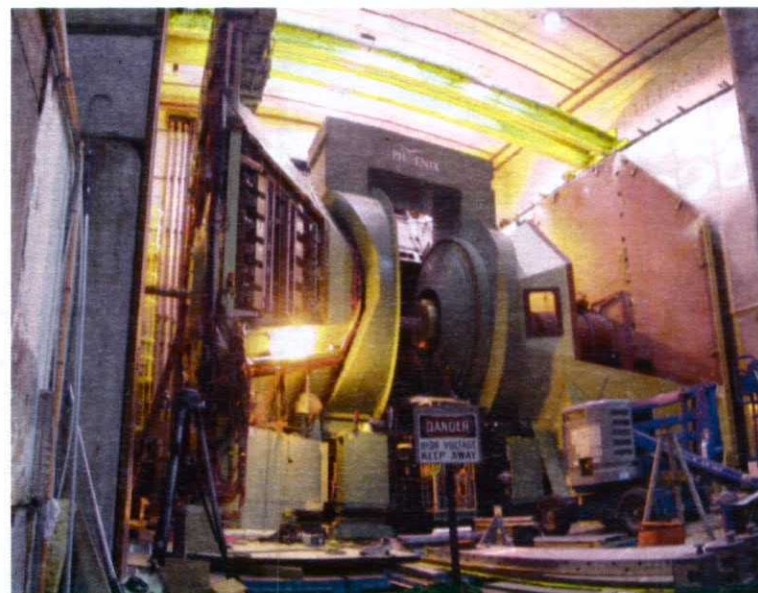
The PHENIX muon spectrometers at RHIC incorporate cathode strip chambers as the tracking detectors. The design requirements for the spectrometers was such that the mass resolution for the vector mesons would allow for a clear separation of the individual states. This led to the requirement that the CSC's have a resolution of 100 microns and the intermediate detector station have a radiation length less than 0.1%. The octant shaped chambers were constructed of a honeycomb panel structure for the first and last station and the middle station used etched 25 micron metalized mylar foils held under tension by thick aluminum frames. The largest chambers, 3.5m x 3.5m, are at station 3. Both spectrometers have now been fully instrumented and data taking has been very successful. We have shown that the chambers have met design requirements. We will describe the design and performance of the chambers for both cosmic rays and real data.

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PHENIX

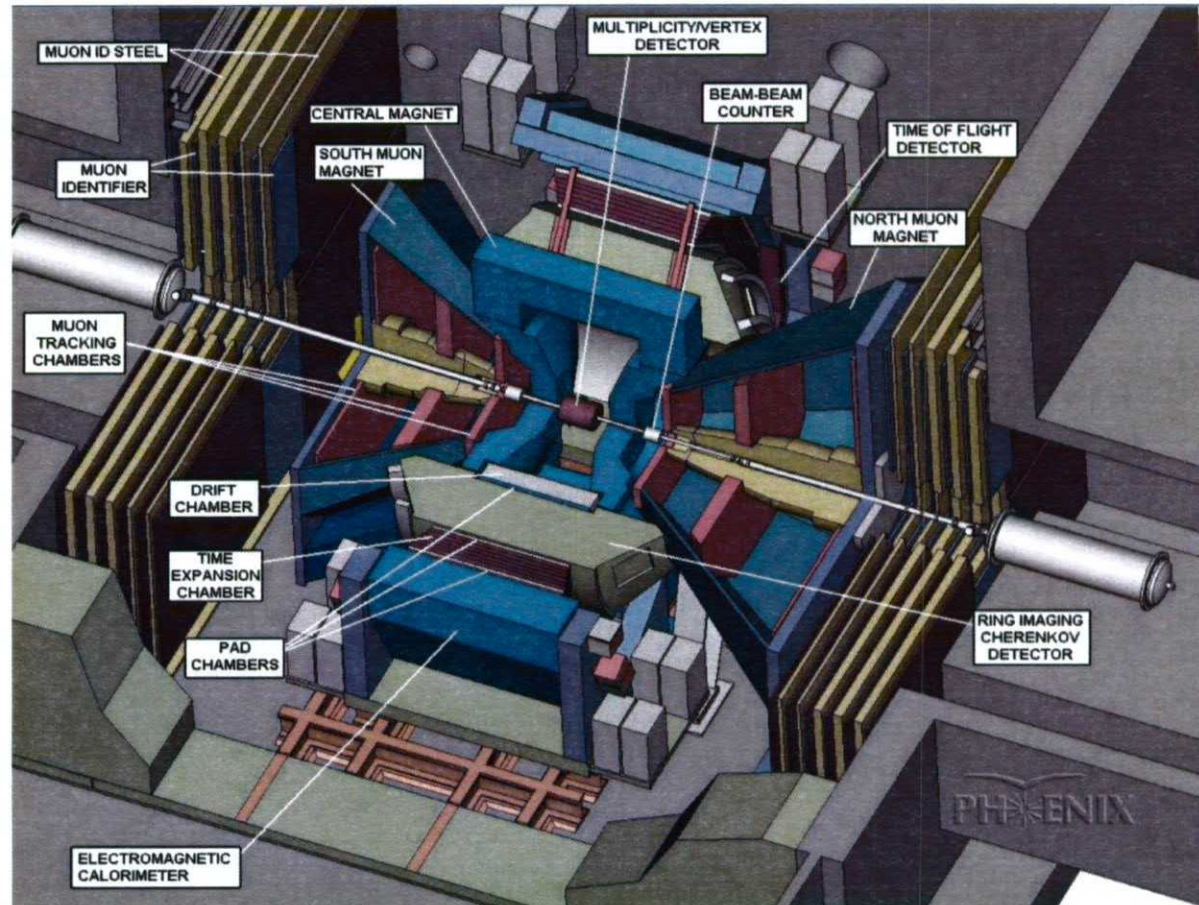
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The Detector



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Physics Processes for QGP search and Spin Physics

- Vector meson production (J/ψ , Y , ϕ , ...)
 - Mass resolution $J/\psi = 150 \text{ MeV}$, $= 200 \text{ MeV}$
- Drell-Yan process (muon pairs)
- Open heavy flavor from gluon collision (muon tag)
- W production (single high-Pt muons)

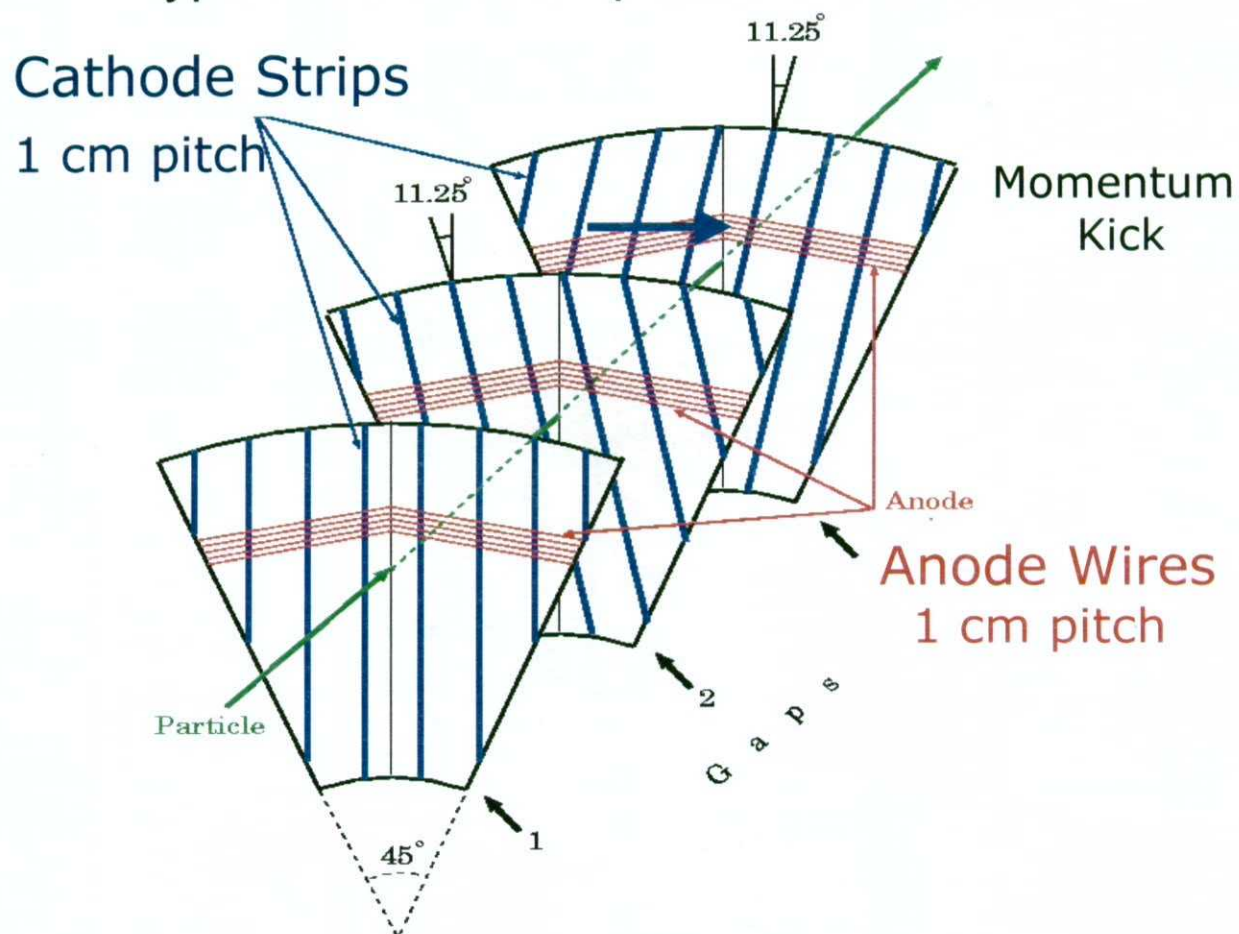
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Cathode Strip Chamber Design Specifications

- $60\text{ }\mu\text{m}$ station resolution \Rightarrow $100\text{ }\mu\text{m}$ chamber resolution
- Angular coverage, polar angle = $10 - 35$ degrees
azimuthal angle = 360 degrees
- Station 2 radiation length $< 0.1\%$
- Maximize acceptance

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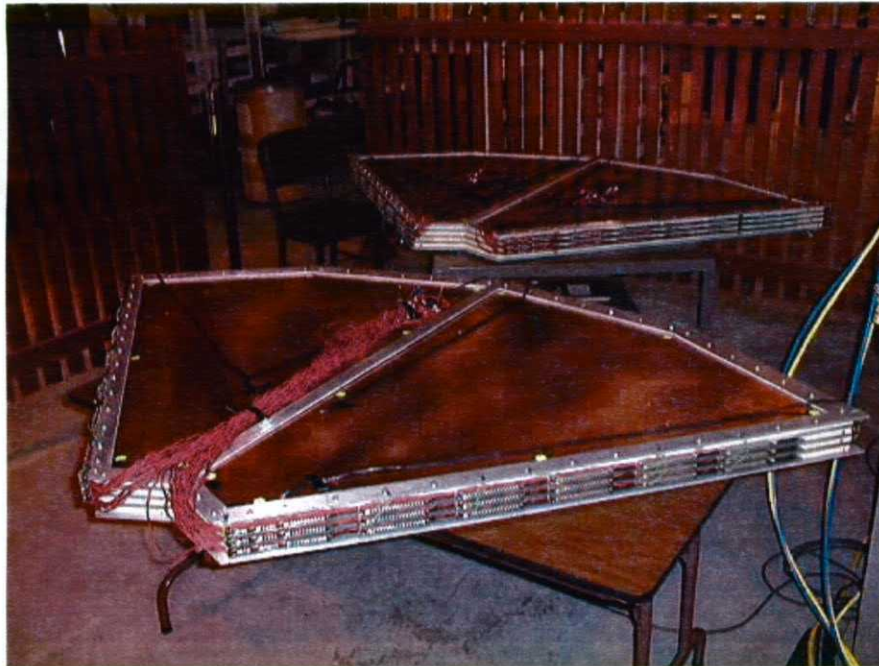
Typical Cathode Strip Chamber Structure



Internal alignment <25 μm

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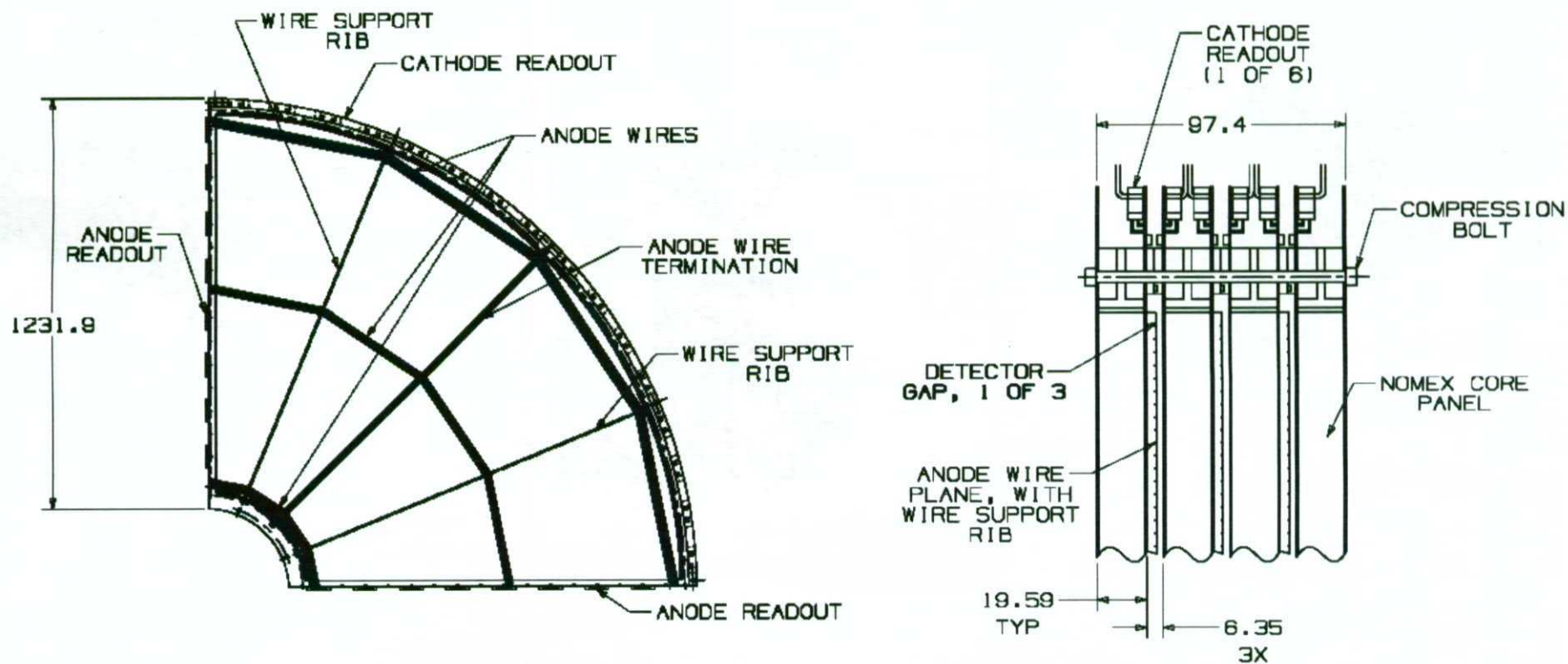
Station 1 Cathode Strip Chambers



- Honeycomb panel design
- Nomex core
- Cathode skins, 0.8mm FR4 with 0.5 oz copper
- Skins photo-etched
- Identical for north and south
- 3 CSC gaps
- 4608 cathode channels
- 2304 anode wires
- Inside to outside radius = 1.2 m

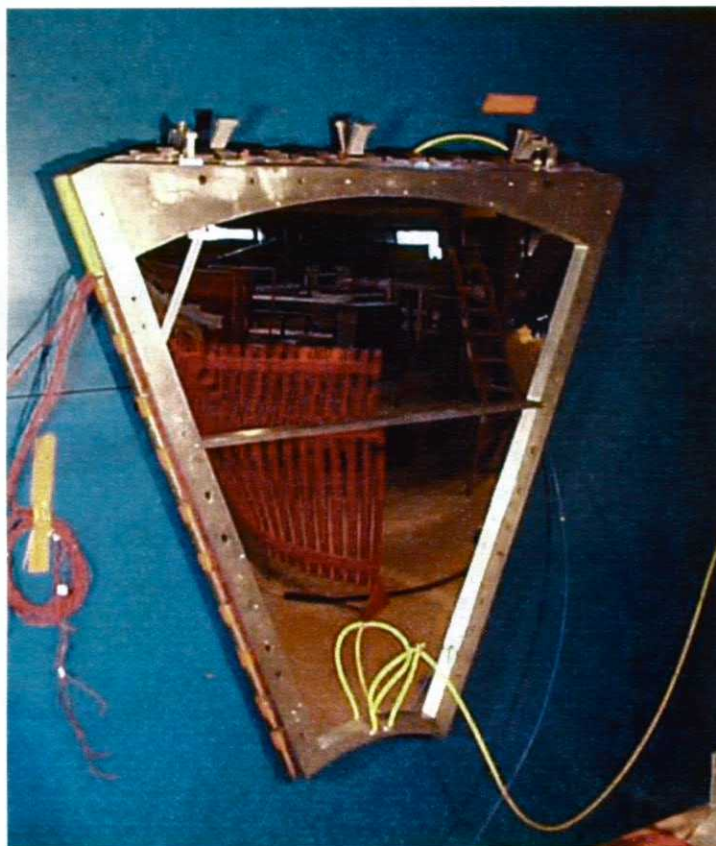
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Station1 schematic and cross section



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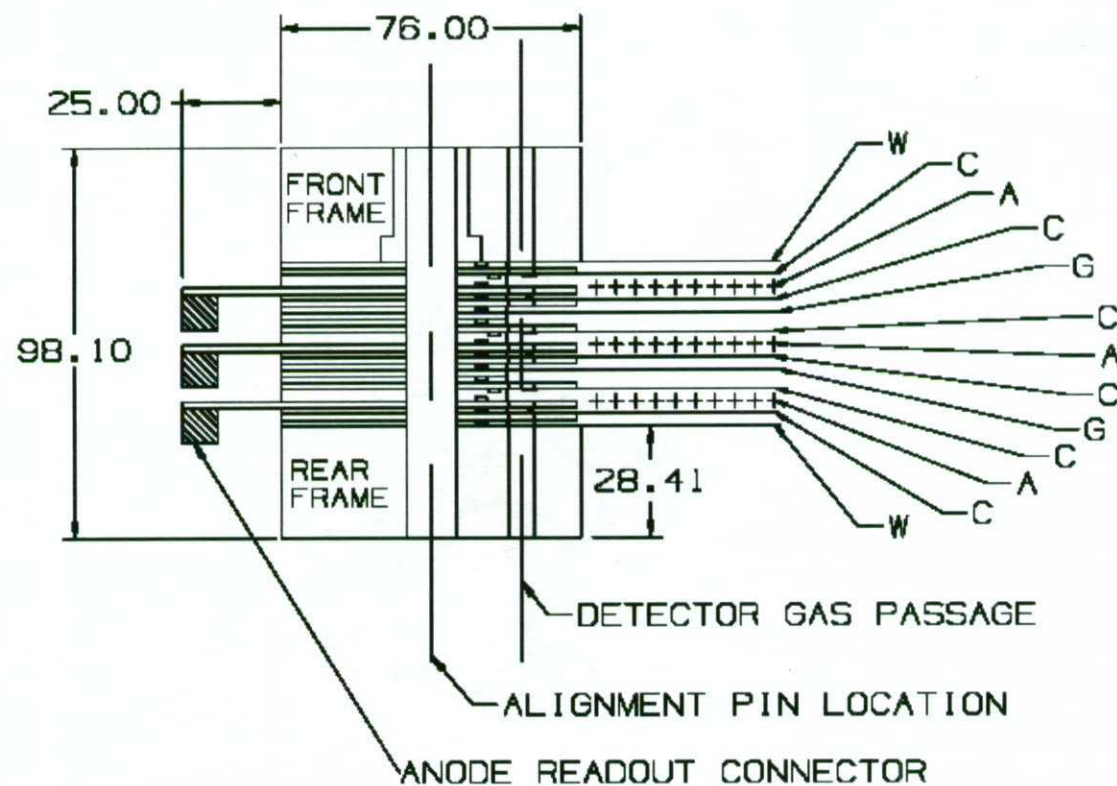
Station 2 Cathode Strip Chambers



- Thin metalized foil design
- Foils are electro-etched
- 3 CSC gaps
- 9216 cathode channels – north
- 7680 cathode channels – south
- 4608 anode wires – north
- 3840 anode wires – south
- Radiation length – 8.5×10^{-4}
- Inner to outer radius = 1.7-2.2 m

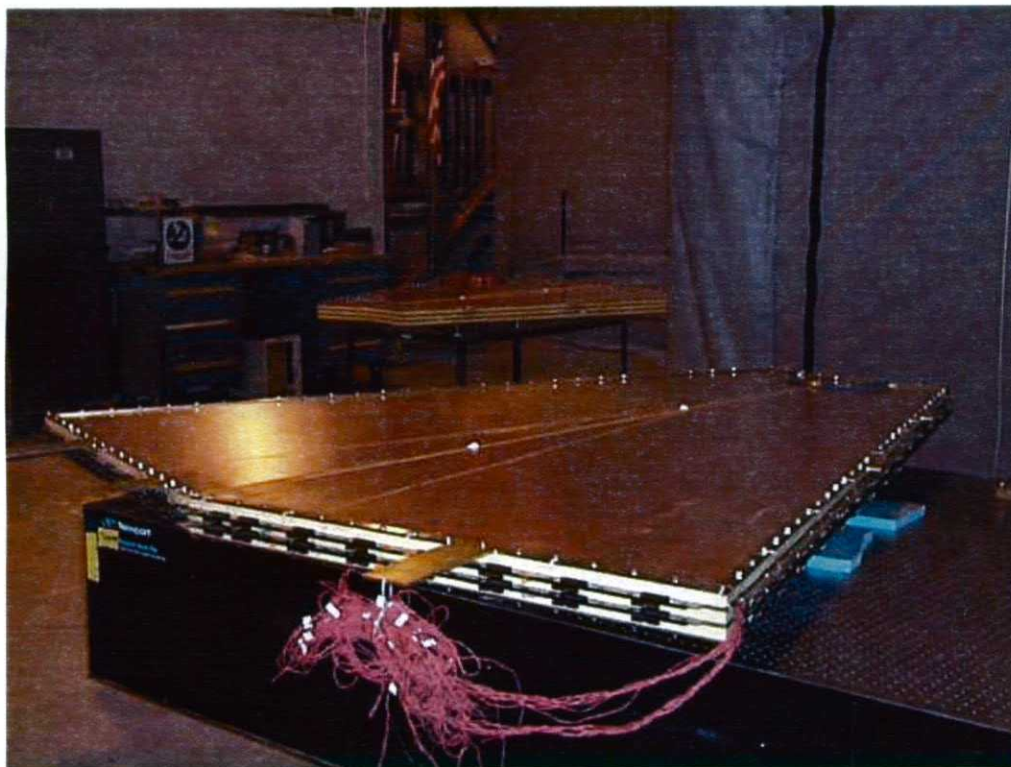
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Station 2 cross section



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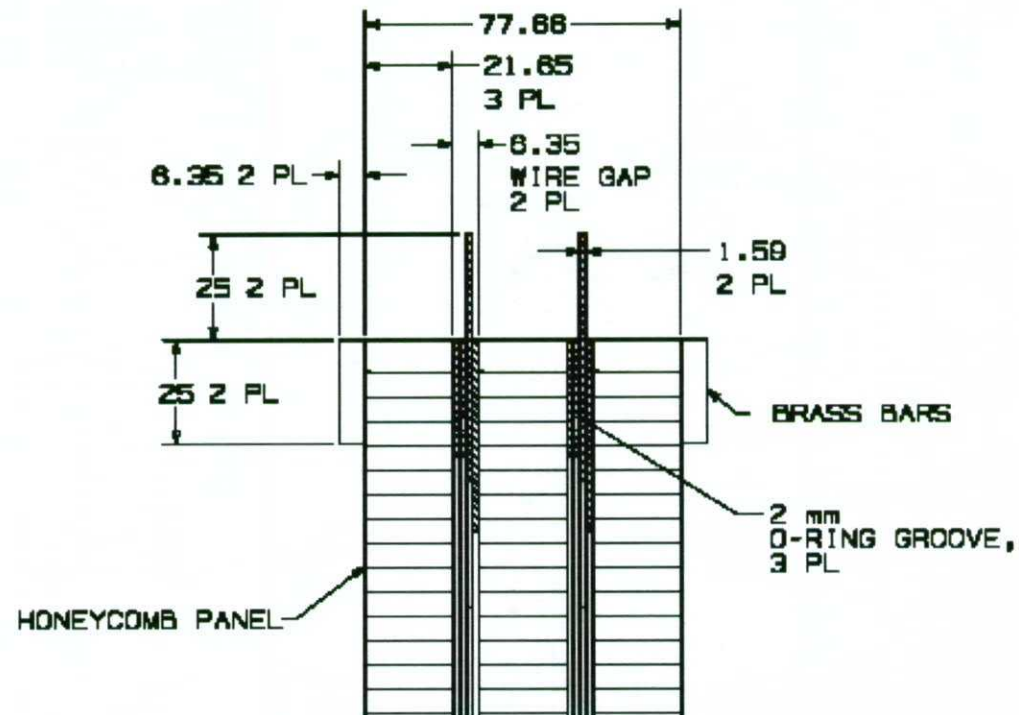
Station 3 Cathode Strip Chambers



- Honeycomb panel design
- Nomex core
- Cathode skins, 0.8mm FR4 with 0.5 oz copper
- Skins mechanically routed
- 2 CSC gaps
- 10240 cathode channels-north
- 8192 cathode channels-south
- 5120 anode wires – north
- 3840 anode channels – south
- Inner to outer radius – 2.4,3.3 m

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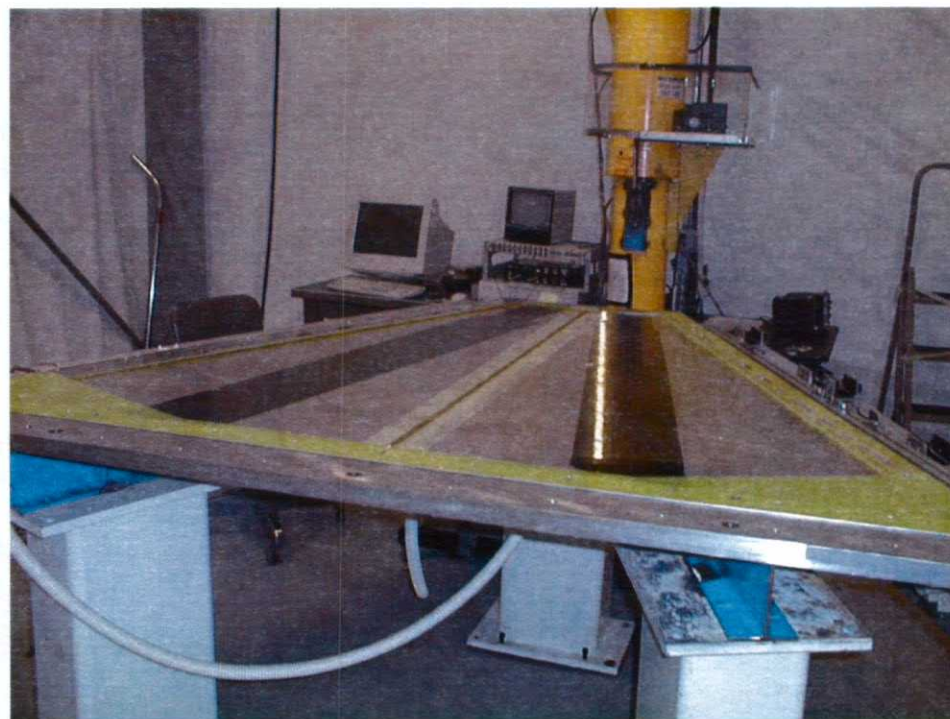
Station 3 cross section



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Clean tent (~2000 Sq. Ft.) showing the two winding stations.



Station 2 wire winding station. Visible is the Thin center rib where wire direction changes by 22.5 deg.

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Station 3 Winding Machine



Station 3 wire winding machine in operation on a south octant. The table is flat to 0.5 mm

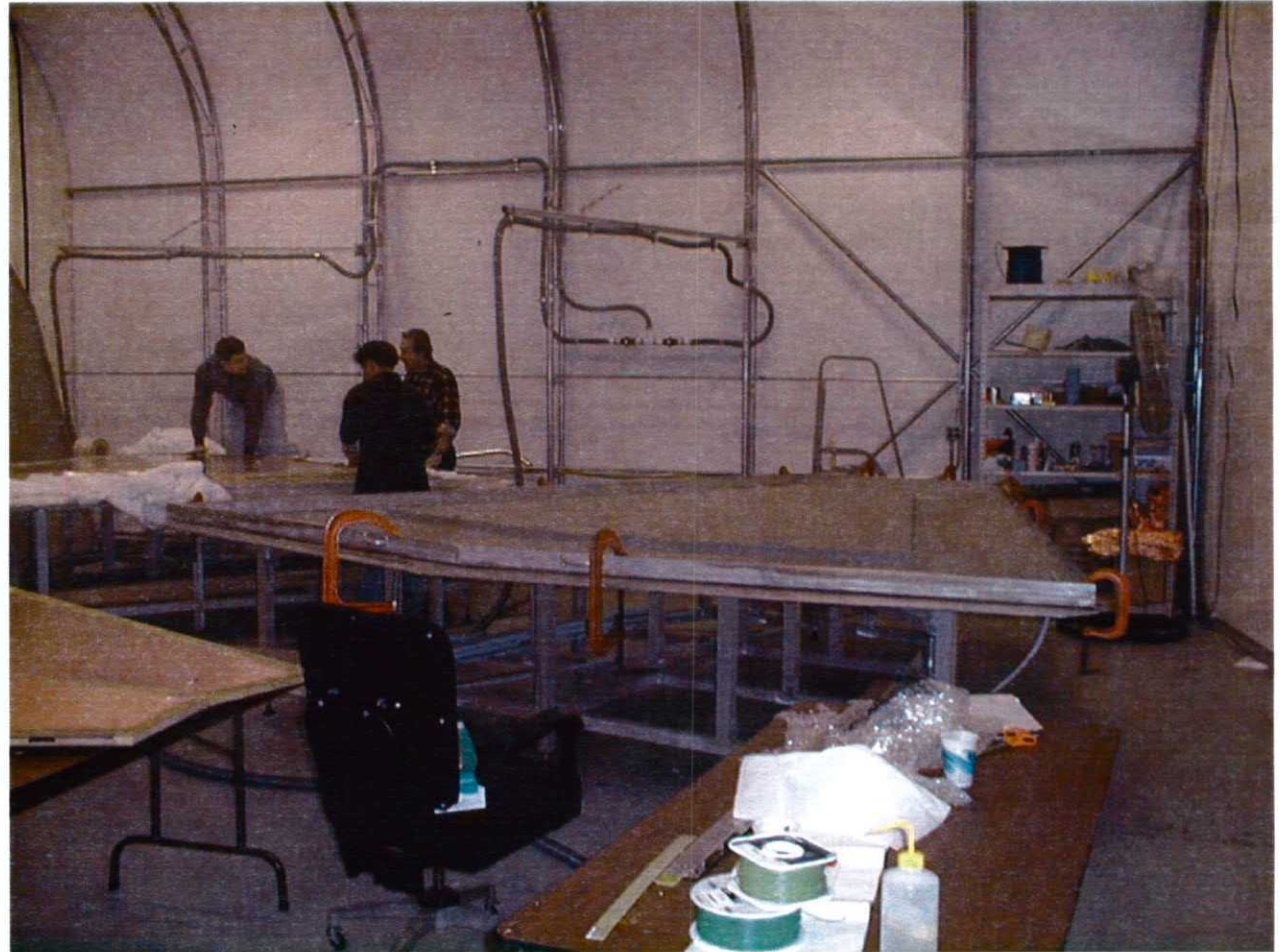
Wire winding head on the left and the tension measuring head is on the right.

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Station 3 vacuum bagging operation.

Two half octants are glued to form the full octant.

Precision drill jigs with 7 alignment pins hold the half octants in place during the curing process.

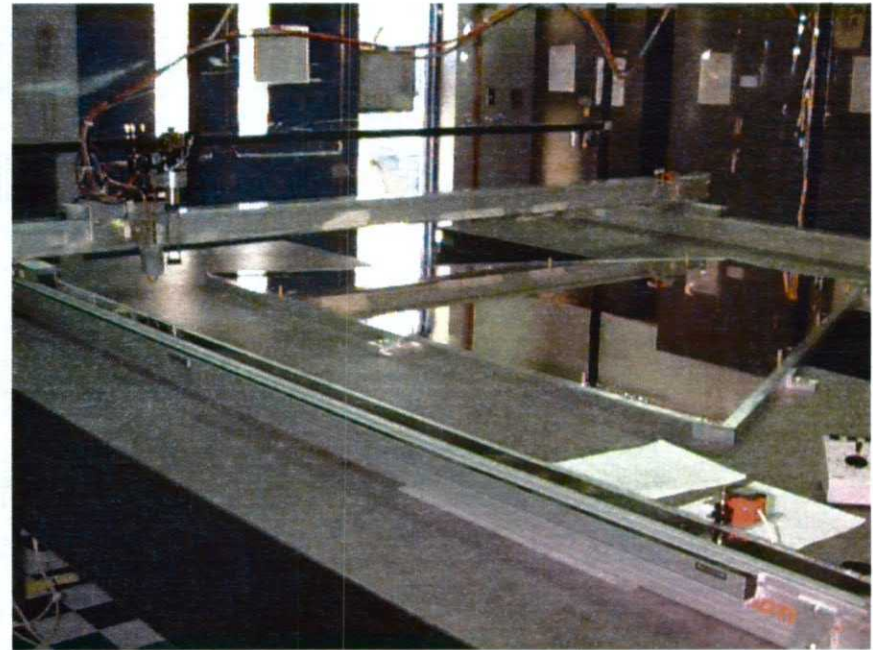


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Station 2 manufacturing process

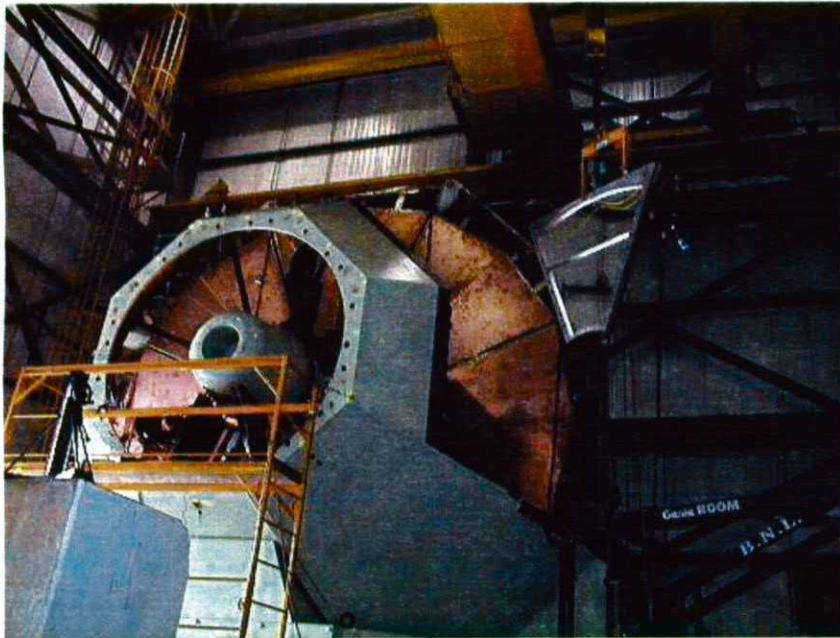


Gluing metalized foil to cathode frame



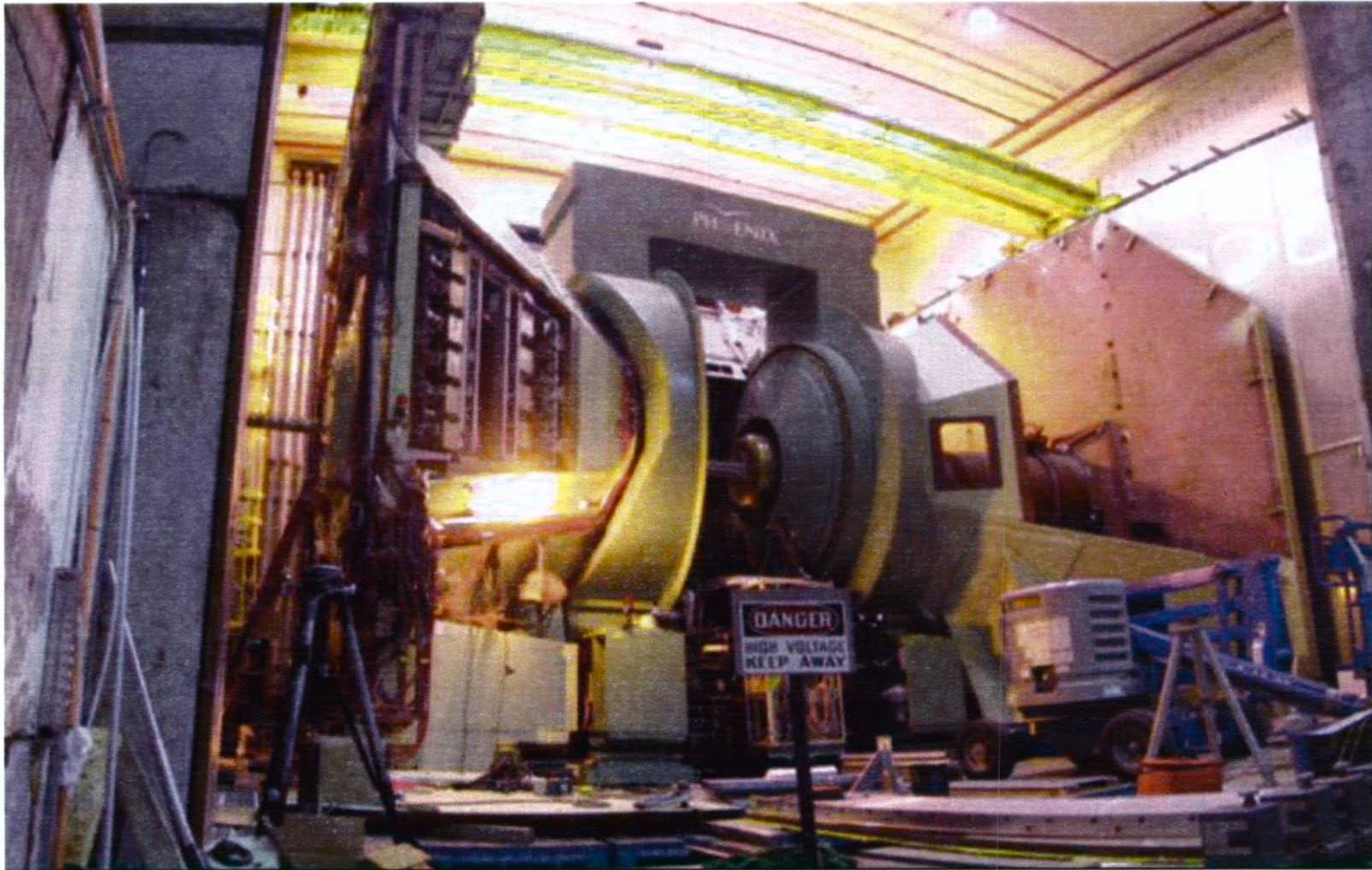
Cathode foil on etching table. Visible are the three linear actuators and the etching head.

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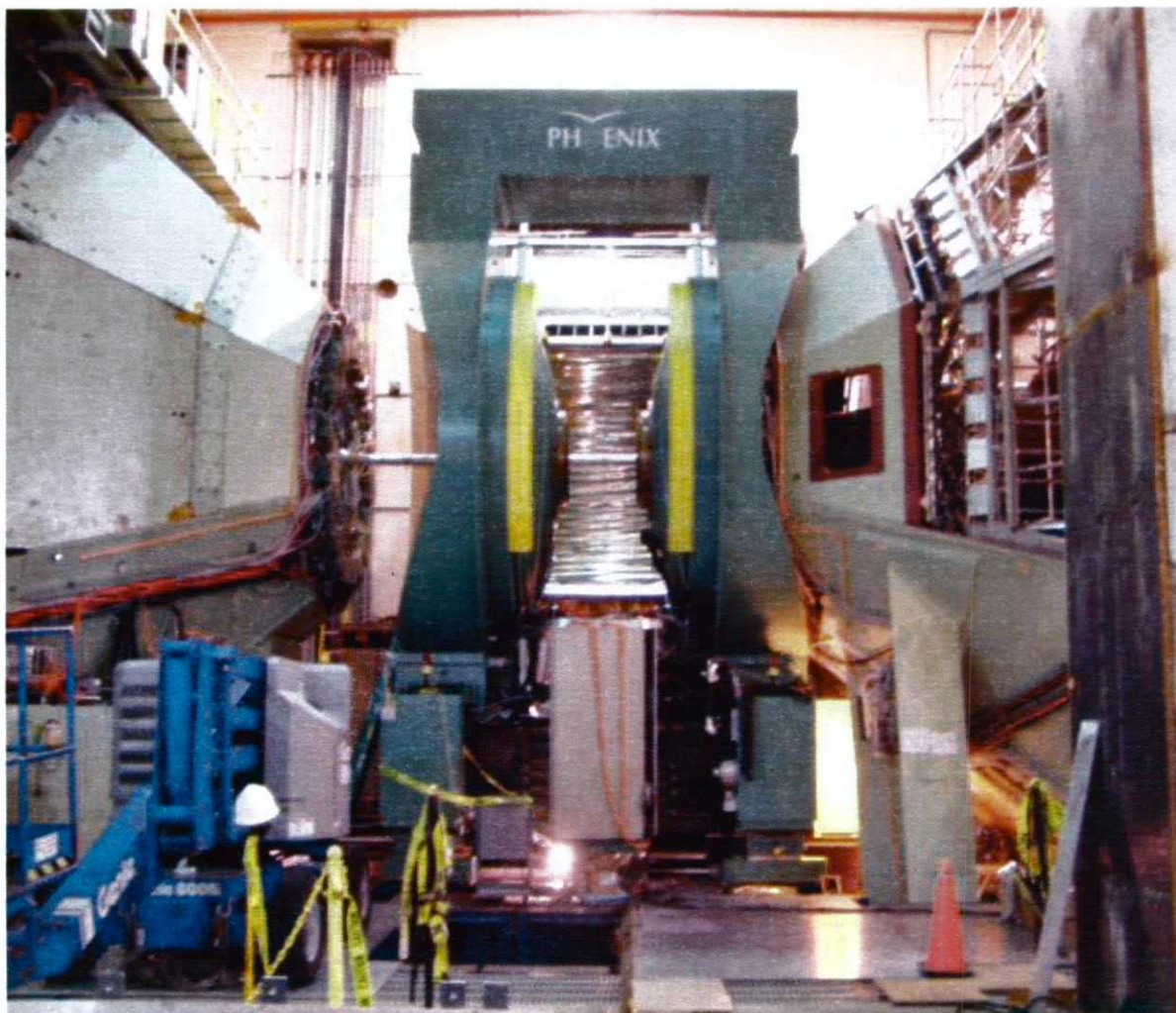


D M Lee 10-22-2003

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Summary and Conclusions

- The PHENIX Muon spectrometers are meeting design goals
- The cathode strip chambers are fully operational and have performed well for the last two runs